DOCUMENT RESUME

ED 143 694 TM 006 460

AUTHOR Fisher, Kathleen M.; And Others
TITLE The Effectiveness of Video-Autotutorial Instruction for a Very Large Enrollment University Course in Science.
PUB DATE Apr 76
NOTE 6p.; Paper presented at the Annual Meeting of the Western Psychological Association (56th, Los Angeles, California, April 8-11, 1976)

EDRS PRICE MF-$0.83 HC-$1.67 Plus Postage.
DESCRIPTORS Academic Achievement; *Audiovisual Instruction; Autoinstructional Laboratories; *Autoinstructional Programs; College Students; Genetics; Higher Education; Predictor Variables; *Program Effectiveness; *Program Evaluation; *Science Courses; Student Attitudes

A. TRACT

The effectiveness of video-autotutorial instruction in a large enrollment course was contrasted to more traditional instructional approaches. Subjects were 555 students enrolled in introductory genetics courses at three University of California campuses. The experimental approach used 25-minute videotape modules, a detailed syllabus, and a learning center staffed by faculty and teaching assistants. One-way analyses of variance on both pretest and final test scores indicated significant differences among the groups. Multiple regression analyses were performed to estimate the relative contributions of student background variables, pretest performance, and instructional treatment on final test scores as the criterion of achievement. Considered singly, the most potent predictor was instructional treatment, followed by grade point average, and then pretest performance. (Author/MV)

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ED143694

The Effectiveness of Video-Autotutorial Instruction for a Very Large Enrollment University Course in Science

KATHLEEN M. FISHER, University of California, Davis
HARTMUT GUENTHER, University of California, Davis
PHILIP H. SORENSEN, Stanford Research Institute
DOROTHY E. STEWART, Stanford Research Institute

Presenter

Philip H. Sorensen
Education Research Department
Stanford Research Institute
333 Ravenswood Avenue
Menlo Park, California 94025

WESTERN PSYCHOLOGICAL ASSOCIATION
Annual Meeting, April 1976

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Background

An introductory upper division course in Genetics at a University of California campus attracts enrollments of 800 or more students each quarter. Over the past few years, faculty members responsible for the course have been experimenting with an autotutorial instructional format as a more effective alternative to conventional lectures and discussion groups. By fall quarter of the 1973-74 school year, the video-autotutorial (video-AT) format was characterized by the following features:

1. Instructional units or modules, each of about 25 minutes in length, on videotape. About 25 such modules cover the scope of one quarter's instruction.
2. A learning center in which viewing can occur throughout the day and evening. Both theater-style viewing and individual carrels are available.
3. An area manned by faculty or teaching assistants in which conferences may occur.
4. A detailed syllabus keyed to the video modules, augmented by suggested textbook readings.
5. Frequent quizzes of material from clusters of modules.

During the 1973-74 school year, a preliminary evaluation of the video-AT procedure was conducted in cooperation with faculty teaching comparable introductory courses in Genetics at two other University of California campuses. Results of that comparison were promising and have been reported elsewhere. *

Based on experience from the 1973-74 evaluation, modifications in the video-AT procedures were made and refinements in the evaluation procedures took place. The principal changes in the evaluation plan were to (1) improve the quality control of data collection and (2) revise both pretests and final tests to realize greater curricular validity and, if possible, increase test reliability. In addition, to ease somewhat the data collection demands upon students, students were sampled to reduce the number at the experimental campus from whom all types of background, attitudinal, and test performance data were obtained.

The evaluation reported in this paper covers the fall quarter, 1974-75, in which the modifications summarized above had been incorporated.

Procedures

Students enrolled in introductory courses in Genetics at three University of California campuses in fall quarter, 1974-75, constituted the subjects. Student background questionnaires, pretests, and final tests were administered; key data

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* "A Comparative Evaluation of the Effectiveness of Auto-tutorial Methods of Instruction," AERA Annual Meeting, Washington, D.C., April 3, 1975 (paper presented by Philip H. Sorensen).

were obtained from 623 students (153 from control campus A, 84 from control campus B, and 386 from experimental campus C). Some 68 cases from the total of 623 were excluded from multiple regression analyses due to missing data on certain variables. Thus, while 623 represents the number of cases for the overall test of effectiveness against the achievement criterion, regression analyses involving variables other than pretests and final tests involved 555 students (225 from the combination of campuses A and B and 330 from Campus C).

Identical forms of student background questionnaires and pretests of genetics knowledge were administered on all three campuses at the outset of the quarter. (On Campus C, pretests were administered to nearly 800 students but data reported herein are confined to the 386 randomly selected students who completed both the pretest and the background questionnaire. Also, on Campus C, additional data regarding use of the video-AT learning center and other components of the video-AT approach were obtained.) Questionnaires were again administered at the end of the quarter to measure changes in attitudes and opinions that might be attributed to the instruction. Scores on a final test common to all three campuses were obtained at the end of the quarter.

The overall test of instructional effectiveness was performed against the criterion of achievement as measured by the final test of genetics knowledge. One analysis involved comparisons across the three campuses on both pretest and final test by a one-way analysis of variance design. Final test performance was analyzed both according to total groups and subgroups based on a stratification of pretest scores to examine the extent to which instructional methods might be differentially effective for students who began formal instruction with differing degrees of knowledge of genetics. For reasons that will be apparent from discussion of these data, an analysis of covariance using pretest as a single covariate was not considered appropriate.

A second analysis employed a linear multiple regression model in which background, pretest, and instructional treatment variables were examined singly and in combination so that the proportion of total variance in the criterion that was accounted for by the equation could be attributed to predictors uniquely or jointly.

Results

Performances by students on the two control campuses and the experimental campus on the pretest and the final test are summarized below:

	Mean Percent Correct	
	Pretest	Final Test
Control Campus A (N=153)	59.4	69.3
Control Campus B (N=84)	59.4	70.1
Experimental Campus C (N=386)	49.8	81.6
All Campuses (N=623)	53.5	77.0

One-way analyses of variance on both pretest and final test scores indicated significant differences among the campuses. The F-ratio on the pretest was 28.37 ($p < .001$ with 2/620 df) while the F-ratio on the final test was 61.18 ($p < .001$ with 2/620 df). Campus C had significantly lower pretest scores than either campuses A or B and had significantly higher final test scores. Campuses A and B did not differ from on another on either measure.

The combined distribution of pretest scores was split into approximate thirds so that final test scores also could be compared across campuses within strata defined by the pretest scores. Final test means within these strata were as follows for the three campuses:

	Strata Based on Pretest Raw Scores		
	Low Third (11 or less)	Mid-Third (12-15)	High Third (16 or more)
Control Campus A			
Final test % correct	62.2	64.6	76.2
Number students	31	53	69
Control Campus B			
Final test % correct	64.8	66.5	74.1
Number students	14	27	43
Experimental Campus C			
Final test % correct	76.4	83.4	87.9
Number students	157	140	89
All Campuses			
Final test % correct	66.8	76.8	80.9
Number students	202	220	201

Multiple regression analyses were performed to estimate the relative contributions of student background variables, pretest performance, and instructional treatment on final test scores as the criterion. In this analysis, students from the control campuses A and B were coded as identical to one another to provide a two-valued score for the instructional treatment variable.

The best overall regression solution involved 9 predictor variables--instructional treatment, pretest, and seven student background variables. The overall multiple regression coefficient was .666 which, when corrected for shrinkage, reduced to .659. Thus, some 44% of the total variance in the criterion was accounted for by these variables in combination.

The analysis was undertaken in such a way that explained variance could be partitioned according to source within the assumptions of an additive model. The results of that analysis indicated the following:

Attribution	Percent of Total Explained Variance
Student background variables	27.8
Pretest	10.7
Instructional treatment	43.1
Joint contribution	18.4

Considered singly, the most potent predictor (based on the beta weights) was instructional treatment. This was followed by grade point average (one of the seven student background variables) and then by pretest performance. The remaining six background variables ranked 4th through 9th in weights among the nine predictors.

MULTIPLE AND PARTIAL CORRELATIONS OF INSTRUCTIONAL FORMAT, PRETEST, AND STUDENT BACKGROUND VARIABLES WITH FINAL TEST PERFORMANCE

Predictor Variables	Simple Correlation	Multiple and Partial Correlations According to Step in Which Predictor Variable Entered Equation*									Square of Multiple Correlation
		1st	2nd	3rd	4th	5th	6th	7th	8th	9th	
Instructional format	398	398									158
Pretest	273	439	566								320
Grade point average	363	370	287	613							376
Qtrs. in univ. system	054	211	143	216	636						405
Certainty of occupational preference	-053	-092	-079	-129	-142	646					417
College is necessary	132	160	102	093	100	135	654				428
Expected grade	273	222	151	087	100	125	113	660			435
Size community in which lived at age 16	-141	-038	-064	-060	-075	-071	-087	-086	663		439
Qtrs. in community college	-141	-243	-172	-180	-063	-054	-065	-077	-083	666	443

Note: All coefficients rounded and decimals omitted. n = 555 for all correlations.

* Multiple correlation coefficients are underscored and appear on diagonal. Partial correlations below the diagonal show the relationship of each predictor variable to the criterion (final test score) when the influence of variables in the regression equation at each step have been eliminated. Correlations involving the instructional format variable are point-biserial.